Case Report

Concomitant fat embolism syndrome and pulmonary embolism in a patient with a femoral shaft fracture

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Case: A 22-year-old man was injured in a traffic accident and developed respiratory distress on his first day of admission. On postadmission day 3, he developed serious respiratory distress with a suddenly altered mental status. Chest computed tomography revealed a pulmonary embolism that had not been evident when he was admitted. The patient was intubated and a continuous heparin infusion was started to treat the pulmonary embolism. Palpebral conjunctival petechiae were noticed the following day, at which point the patient fulfilled Gurd's criteria for fat embolism syndrome. Within a few days, his respiratory status was improved. Brain magnetic resonance imaging also provided evidence of fat embolism syndrome. His femoral shaft fracture was repaired on day 20.

Outcome: The patient was discharged home on postadmission day 63.

Conclusion: Concomitant fat embolism syndrome and pulmonary embolism, although very rare, should be considered when a trauma patient's respiratory status worsens.

Key words: embolism, fat, intensive care unit, pulmonary embolism, respiratory failure

INTRODUCTION

FAT EMBOLISM SYNDROME (FES) is common in patients with long bone fractures and is a differential diagnosis of acute respiratory distress in patients with multiple trauma.[1] Patients with multiple trauma are also likely to develop pulmonary embolisms.[2] Therefore, differentiation between FES and pulmonary embolism is important because of their different treatment requirements. However, cases of concomitant FES and pulmonary embolism are very rare. We herein describe this unusual clinical occurrence in a patient with multiple trauma who sustained a femoral shaft fracture.

CASE

A 22-YEAR-OLD MAN, WITH no significant medical history, was injured in a collision between a motorcycle and a car. When he arrived at the hospital, his blood pressure was 138/58 mmHg, pulse rate was 90 b.p.m., respiratory rate was 40 breaths/min, oxygen saturation was 89% while on a non-rebreather face mask, and Glasgow Coma Scale score was E3V5M6.

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Head computed tomography (CT) revealed insignificant findings, and chest CT revealed right pneumothorax with a ground-glass opacity of uncertain cause (Fig. 1). Radiographs revealed a spiral left femoral shaft fracture in the subtrochanteric zone (Orthopedic Trauma Association classification type 32-A1.1). The pneumothorax did not require chest tube placement, and the femoral shaft fracture was treated with skeletal traction. The patient was admitted to the intensive care unit.

On postadmission day 2, he developed a fever of 38.3°C, however, his respiratory and circulatory conditions were stable. On post admission day 3, the patient developed serious respiratory distress with an oxygen saturation of <80%, blood pressure of 80/46 mmHg, pulse rate of 120 b.p.m., and suddenly worsened consciousness. The patient was intubated, and contrast-enhanced chest CT revealed a pulmonary embolism that had not been present on the first day of admission; the ground-glass opacity, potentially indicative of FES, persisted (Fig. 2). His hemoglobin level dropped from 16.3 g/dL on postadmission day 1 to 13.7 g/dL on postadmission day 3; his platelet count also dropped from $20.8 \times 10^4/\mu L$ (day 1) to $10.0 \times 10^4/\mu L$ (day 3). However, the only identified source of bleeding was at the fracture site. In the absence of confirmed bleeding, a continuous heparin infusion (14,000 U/day) was started to treat the patient's pulmonary embolism on day 3.

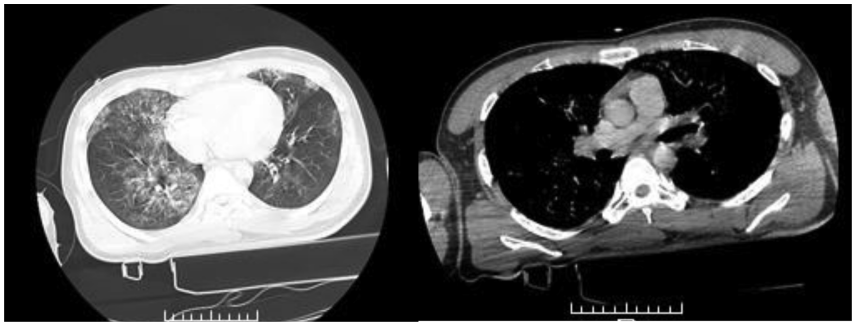

Fig. 1. Chest computed tomography on the day of admission of a 22-year-old man who developed respiratory distress after admission for a traffic accident injury. A ground-glass opacity of uncertain cause is present.

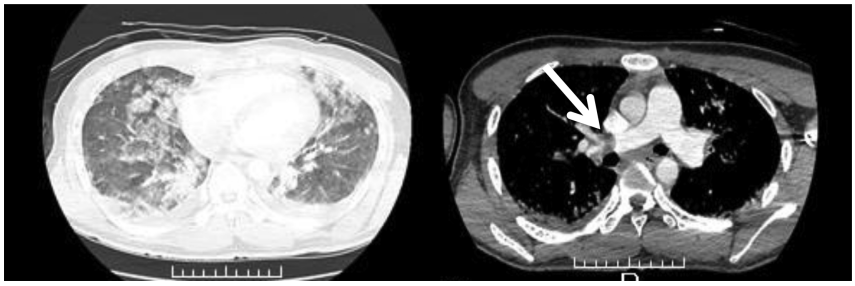

Fig. 2. Chest computed tomography on postadmission day 3 of a 22-year-old man who developed respiratory distress after admission for a traffic accident injury. A pulmonary embolism is present in the right main pulmonary artery (indicated by the white arrow). The ground-glass opacity persisted and was considered to be possible evidence of fat embolism syndrome.

On postadmission day 4, petechiae appeared on the patient's palpebral conjunctiva. The following day, he was extubated because his respiratory status had improved. Within 3 few days after extubation, oxygen administration was no longer required. Brain magnetic resonance imaging was carried out on days 8 and 37. Diffusion-weighted imaging (DWI) showed diffuse white matter signal intensity changes that had completely resolved on day 37. Susceptibility-weighted imaging revealed petechial hemorrhages (Fig. 3). Although the patient's consciousness improved, he remained disoriented until day 18. We did not check his erythrocyte sedimentation rate, nor did we observe fat globules in his sputum or urine. A fundoscopic examination was not carried out.

Over the course of hospitalization, ultrasonography of the lower extremities was carried out twice to identify the cause of the patient's thrombosis, but no thrombus was detected. On postadmission day 20, we surgically repaired his left femoral shaft fracture using intramedullary nails. The patient was discharged to his home on day 63. He still showed signs of memory disturbance at the time of discharge.

DISCUSSION

AS DEFINED BY Gurd, the clinical signs of FES include progressive respiratory distress, petechial rashes, and an altered mental status.[3] Gurd defined major and minor criteria for the diagnosis of FES (Table 1). The symptoms typically develop gradually during the first 12–72 h after injury.[4] Respiratory symptoms are usually the earliest signs of FES, presenting as tachypnea, dyspnea, and cyanosis; these signs occur in 75% of patients. Petechial rashes occur in approximately 30% to 50% of patients.[1] An altered mental status occurs in up to 86% of patients and can manifest as headaches, lethargy, irritability, delirium, stupor, convulsions, or coma. Fortunately, these manifestations of an altered mental status are nearly always completely reversible.[5]

The patient in this case developed respiratory distress when admitted, and his petechiae appeared on day 4, despite generally occurring within the first 72 h post-injury in patients with FES. Additionally, we could not preclude the possibility that the ground-glass opacity observed when he was admitted was the result of a pulmonary contusion. Although confirming the timing of FES development is difficult, our patient fulfilled Gurd's criteria on day 3 (respiratory distress, altered consciousness, tachycardia, pyrexia, sudden drop in hemoglobin level, and sudden thrombocytopenia). He also showed all major symptoms by day 4. Further, this patient's brain magnetic resonance imaging findings confirmed FES. A previous study reported that susceptibility-weighted imaging is an effective method for detecting tiny petechial hemorrhages in the perivascular space of patients with FES.[6] In patients with trauma, differentiation of FES from diffuse axonal injury is important because the latter also causes mental disturbances. Diffuse

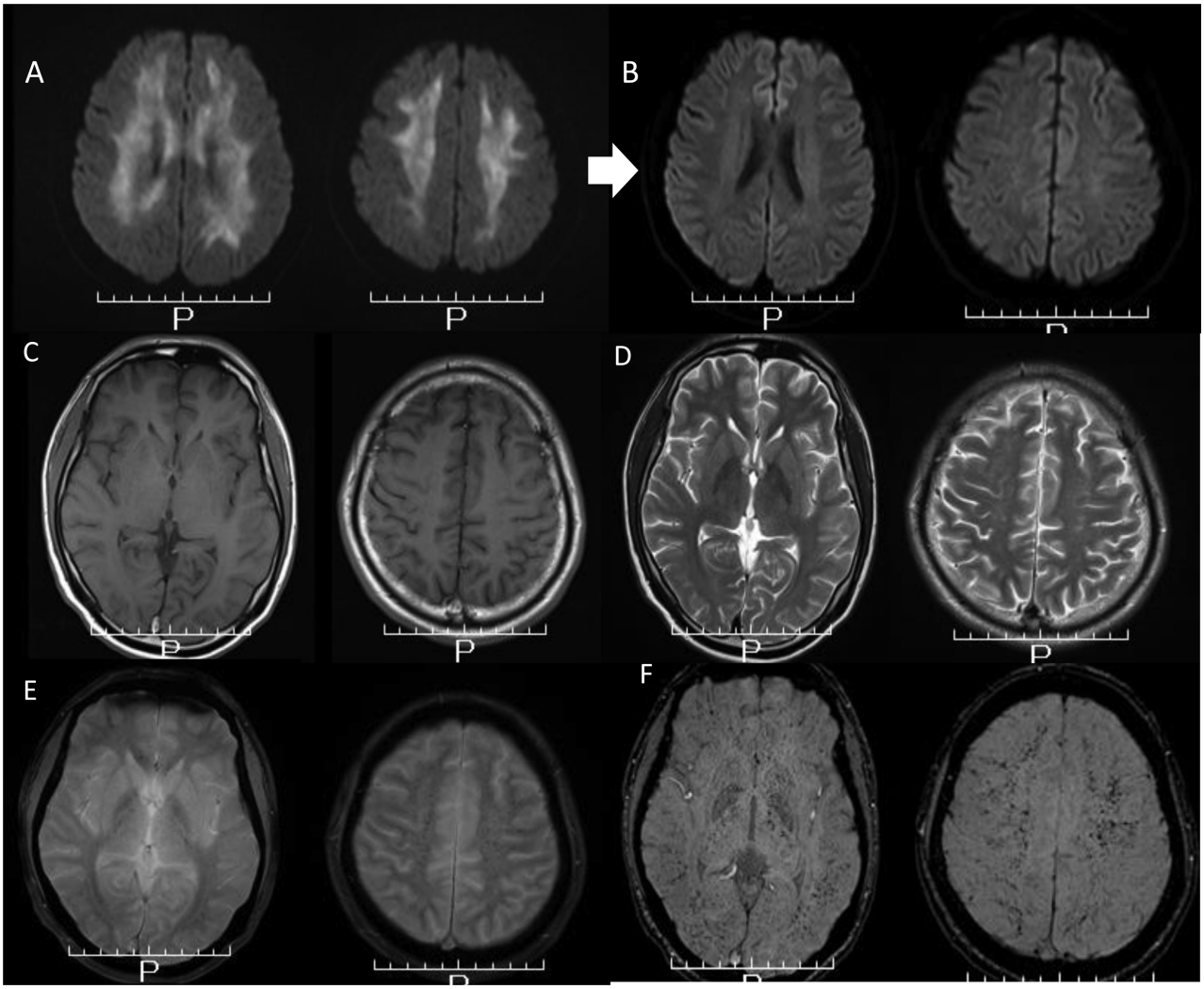

Fig. 3. Imaging of a 22-year-old man who developed respiratory distress after admission for a traffic accident injury. The white arrow indicates the variability over time (A was at day 8. B was at day 37). A, B, Diffusion-weighted imaging showing diffuse white matter signal intensity changes and their complete resolution. C, D, T1-weighted imaging and T2-weighted imaging do not show significant changes on day 37. E, F, T2*-weighted imaging and susceptibility-weighted imaging reveal petechial hemorrhages. P, posterior.

axonal injury typically occurs in regions with a high degree of parallel axonal arrangement, such as the corpus callosum, internal capsules, basal ganglia, brainstem, and subcortical white matter. However, its distribution differs from that of FES lesions, which predominate in the centrum semiovale.[7] A previous study also reported the presence of hyperintense lesions on DWI situated in the cerebral white matter of patients with FES.[8] Considering the distribution of petechial hemorrhages and the reversible, diffuse, hyperintense lesions observed on DWI in our patient, the cause of his altered consciousness was most likely FES.

The timing of anticoagulant therapy in trauma patients with pulmonary embolisms is controversial. In the present case, anticoagulant therapy was started soon after diagnosis of the pulmonary embolism because a bleeding source could not be found, and his anemia and thrombocytopenia were consistent with the course of FES. Fat embolism syndrome and pulmonary embolisms are common differential diagnoses of respiratory distress in patients with multiple trauma. However, concomitant FES and pulmonary embolism is rare; we have found only one other such case described in published reports. Cothren *et al*.[9] reported a case of concomitant FES and pulmonary embolism in a patient with a fractured pelvis. They emphasized the importance of considering the simultaneous presence of multiple causes of respiratory distress in these patients. In patients with only FES, supportive

Table 1. One major criterion and four minor criteria for diagnosis of fat embolism syndrome, developed by Gurd[3]

Major criteria
1) Petechial rash
2) Respiratory symptoms plus bilateral signs with positive radiographic changes
3) Cerebral signs unrelated to head injury or any other condition
Minor criteria
1) Tachycardia
2) Pyrexia
3) Retinal changes (fat or petechiae)
4) Urinary changes (anuria, oliguria, fat globules)
5) Sudden drop in hemoglobin level
6) Sudden thrombocytopenia
7) High erythrocyte sedimentation rate
8) Fat globules in the sputum

therapy is generally sufficient. However, if a pulmonary embolism is also present, an inferior vena cava filter or anticoagulant therapy is indicated. Therefore, concomitant FES and pulmonary embolism should be considered in trauma patients who experience worsening respiratory distress.

CONFLICT OF INTEREST

NONE.

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